Biofacies Study of Selected Shoals Northwest Of Arabian Gulf

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Abstract

The study deals with the sediment biofacies of the northwestern part of Arabian Gulf near the entrance of Shatt Al-Arab and the southern entrance of Khor Abdulla. Gravity corer device was used of about 60 cm penetration .The sampling was carried out from 13 to 15 August 1995. Nineteen samples of vertically and horizontally distribution were chosen to cover the study area. Grain size distribution indicates that the sediments are; sandy mud, muddy sand and mud. The identified foraminiferal species and ostracoda described in the present study lead to identify three biofacies; marine, deltaic marine and lagoonal environments. The fossils of shoals are mixed between recent and ancient foraminifera and ostracoda species, whereas, the ancient shells are very hard lithified, buried in stiff sediments. The foraminifera assemblage in the shoal sediments reveals a beach environment during the regression of the sea level of Holocene age.

Introduction

The northwestern part of Arabian Gulf close to the Shatt Al-Arab River entrance and the southern Khor Abdulla entrance where the shoals found has special situation, due to the exposition to fluctuation in water salinity gave an important in sedimentological and paleontological environment nature of the area.

Al-Abdul-Razzaq *et al.*(1979) investigated the marine benthic microfauna of Kuwait, they

found the foraminifera are the most abundant living benthic microfauna. Elewi and Safawe(1987)studied the recent foraminifera in southern Iraq. They stated that the miliolidae family is the dominant. Darmoian and Lindqvist(1988)studied the sediments of the estuarin environment of Tigris and Euphrates delta, they proved the sediments are mainly of terrigenous and biogenic origin. Darmoian and Al-Rubaee(1989) recognized 61 species of estuarine benthic foraminifera of Tigris and Euphrates delta. Al-Khuzaee(1998) studied the living and fossil of foraminifera in the northwest Arabian Gulf, used their spreading as index to the pollution. Issa(2006)studied the microfauna(foraminifera and ostracoda) and mollusca in the tidal flats of both Khor Al-Zubair and Khor Abdulla, and navigation channel of Khor Abdulla.

Materials and Methods

Nineteen samples have been collected from nine locations(Fig.1) covering the shoals in the southern entrance of Khor Abdullah and the southern part of Shatt Al-Arab River delta. The sampling was carried out from 13 to 15 August 1995. Gravity corer device was used of about 0.6m penetration. The grain size analysis was obtained by a wet sieving on a sieve of 230 mesh to separate the sand from silt and clay were measured by a SediGraph. The microfaunal samples were wash on 230 mesh sieve to remove the finer (silt and clay) particles. The residue of sand was collected and dried, and then the sample is spread thinly over the picking tray. Specimens of the two groups are removed from the tray using 0.001mm hairbrush and placed in a slide for each group to be study later. The foraminifera and ostracoda slides are examined and identified under a binocular microscope. The classifications of Loblich and Tappan(1988) was adopted for the foraminifera and the suggested classification by Moore and Bitrat(1961 in Peiris, 1969)for the ostracoda.

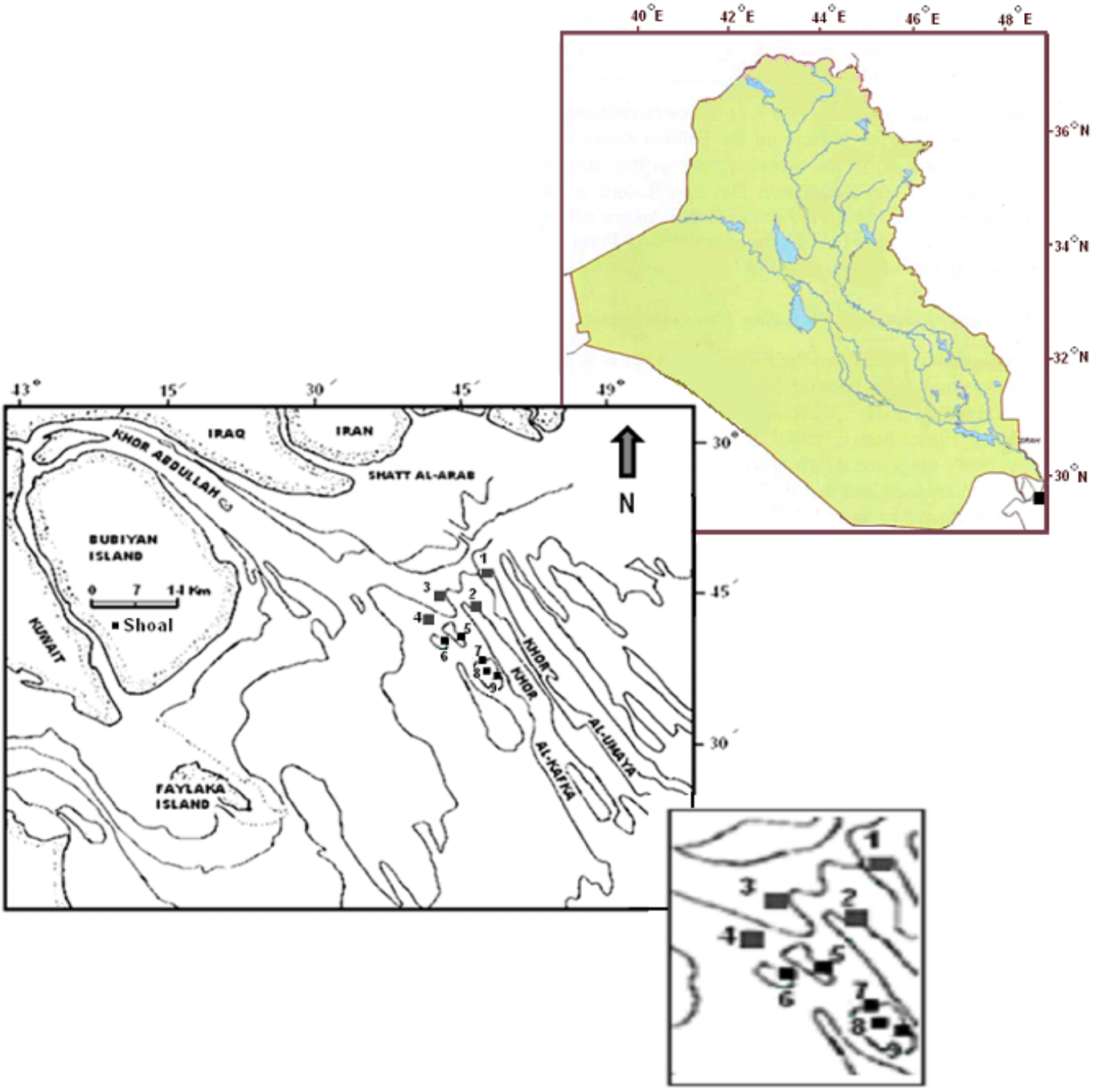


Figure (1) location map of samples.

Results and Discussion:

Sediments

Grain size distribution, according to Folk (1974)shows a variable mixture of three textural types; mud, clayey sand, and sandy mud(Table-1). Mud forms about 47% of the total sediments samples, followed by clayey sand which forms about 29% and at last sandy mud occur in amount 24%.

Statistical grain size parameters of the sediments (Table-1) reveal that there are two populations of sediments in the study area ;a finer, very poorly sorted, negative, very platykurtic or platykurtic population (mud, sandy mud) and a coarser, very poorly sorted, positive, very platykurtic population(clayey sand).This differentiation reflects the nature and the sedimentational conditions dominated during period of the deposition.These conditions could influenced by; tidal currents, estuarine circulation, and bottom erosion. Darmoian and Lindqvist(1988) suggested also the derivation of sediments by these factors, therefore the sediment distribution will be irregular and this in turn explains the variation in the statistical parameters; skewness, kurtosis, and sorting values.

Table- .Average values of the size parameters of sediments types.

Sediment type		Sand %	Silt %	Clay %	Mean M_Z	Sorting σ_I	Skewness SK_I	Kurtosis KG
Mud	Max.	7	42	63	8.87	2.46	-0.42	0.91
	Min.	2	34	55	7.60	1.93	-0.66	0.64
	Av.	4	38	58	8.47	2.24	-0.58	0.81
Clayey sand	Max.	70	15	28	5.13	3.79	0.73	0.71
	Min.	57	9	21	4.23	3.18	0.51	0.50
	Av.	62	13	25	4.87	3.50	0.61	0.58
Sandy mud	Max.	28	31	55	8.23	3.15	-0.32	0.82
	Min.	16	29	41	7.26	2.68	-0.65	0.56
	Av.	21	30	49	7.67	2.91	-0.46	0.66

Biofacies

The identified microfauna specimens from the studied sediment include foraminifera (plate 1-2) and ostracoda (plate 3). According to the microfauna assemblages, the studied area shows different biofacies as :

1- Marine Biofacies (MB):

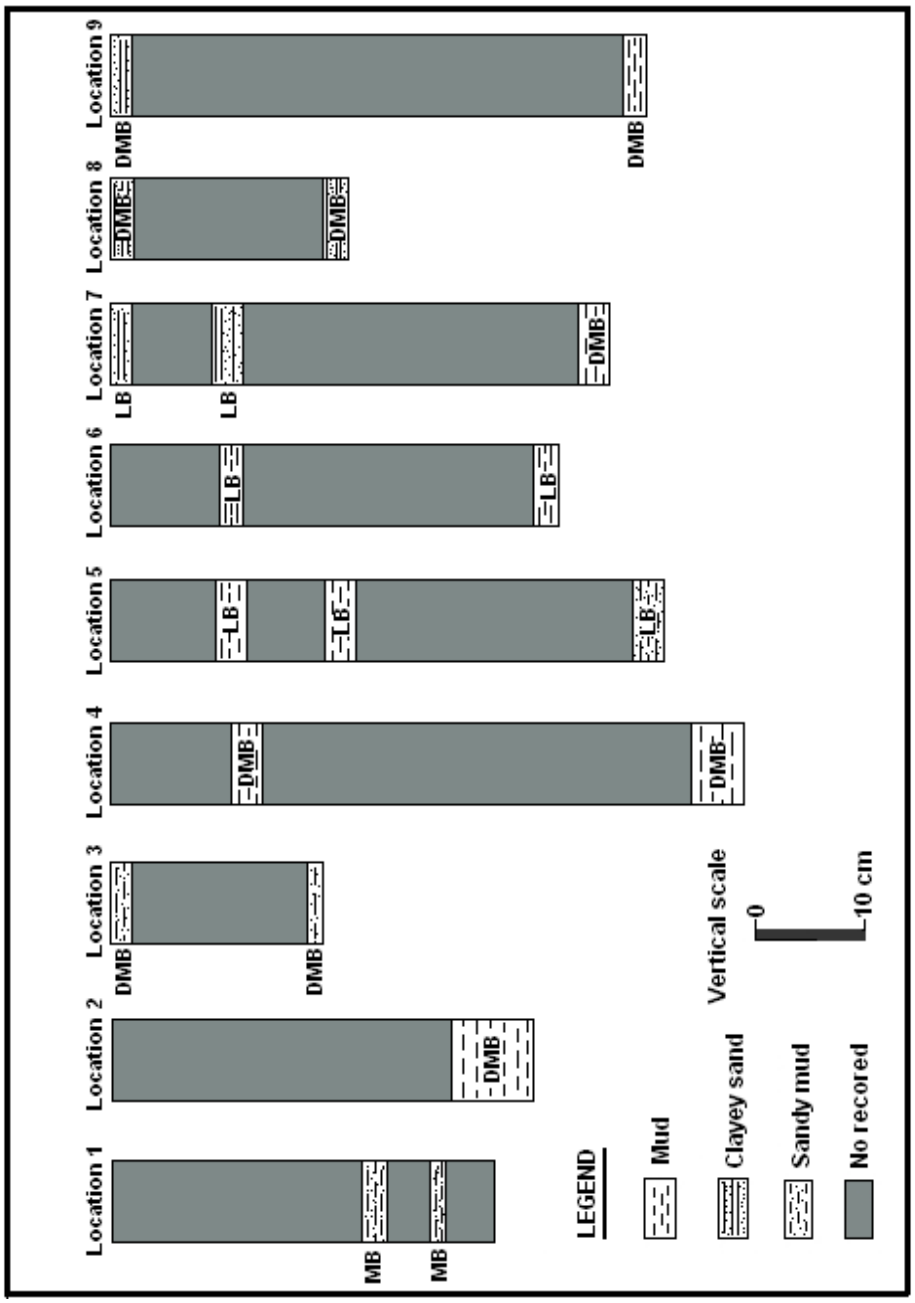
It is located at a depth(24-25.5 cm)and (30.5-31 cm)of the location(1), in sandy mud sediments(Fig.2).The constituent of fauna in this facies are foraminifera which represented by; *Dentostomina sp.*, *Spiroloculina laevigata* , *Quinqueloculina lamarckiana, Q.seminula* , *Triloculina rotunda* , *Lagena laevis* , *Ammonia beccarii*, *Asterorotalia dentate* ,*A.inflata* , *Elphidium discoidal*. All species indicate normal marine environment, with numerous occurrence of Rotaliina individuals which indicate in comparison with remainder let to suggest the shelf marine environment (Murray,1976).In general, the environmental interpretation from the species assemblage of foraminifera is compatible with the species diversity index result for this part of a study area(Darmoian and Al-Rubaee,1989).Other species of ostracoda were present such as;*Cyprideis torosa* var.*torosa* ,*Haplocytheridea bradyi* ,and *Haplocytheridea keyseri*.

2- Deltaic Marine Biofacies (DMB):

This facies was observed in ; mud, sandy mud, and clayey sand texture. It is found at a depth ;(32-40 cm),(0-2 cm),(11-more than 50 cm),(45-48 cm),(0-22 cm), and (0-50 cm) of cores;2,3,4,7,8,and 9, respectively(Fig.2).The foraminifera species are chiefly represented by; *Quinqueloculina seminula*, *Fissurina marginata*,*Bolivina striatula*,*Bulimina marginata*, *Ammonia beccarii*, *Elphidium poeyanum*.In addation other species recorded as;*Textularia conica*, *Dentostomina sp*., *Spiroloculina communis*, *Spiroloculina laevigata*, *Quinqueloculina laevigata*, *Q. longirosta Q.seminulum*, *Triloculina earlandia*,*T.planciana*,*T. rotunda*, *Lagena laevis*, *Lagena sulcuta* froma *interrupta*,*Fissurina serrata*,*Buccella frigida*,*Rosalina columbiensis*, *R.globularis*, *Asterorotalia dentate*, *A.inflata*, *Elphidium advenum*, *E . discoidal* ,*E.incertum*, *E.incertum clavatum*, *E.incertum mexicanum*, *Florilus asterizans*.

Abundance species of the first group could indicate deltaic marine environment,but observation the two groups of foraminifera species together tends to confirm a marginal marine environment too (Murray,1976).The biofacies reflects also the ends of delta with marine water. The environmental explanation

concordant with the suggested interpretation for this part of a study area(Issa,2006).Ostracoda species that found in this biofacies are;*Cytherelloidea sp*., *Cyprideis torosa* var.*torosa*, *Haplocytheridea subovata*, *Haplocytheridea keyseri*, *Hemicytheridea reticulate*,*Cushmanidea guhai*,



Figure(2)Sediment facies and Biofacies of study area.

Neomonoceretina delicata , *Paijenborchellla* (*Eupaijenborchellla*)*sp*., *Carinocythereis indica*,and *Alocopocythere reticulata*. All of these species of ostracoda were recognized in the marine water(Peiris,1969;Al-Abdul-Razzaq *et al*.,1979;Quanhong and Whatley, 1989)except *Cyprideis torosa* var.*torosa* which founds in a wide range of salinity (Carbonnel,1983 and Holmes,1992 in Al-Jumaily and Al-Shiekhly,1997),but the occurrence of smooth form could represent marine environment(Kilenyi,1972).

The other remark can recognize in the samples of this biofacies in the shoal area, especially; 7, 8, and 9. The ancient shell fossils of foraminifera and ostracoda increase with depths of those samples which be solid sediments.The foraminiferal species is; *Quinqueloculina seminulum*,*Buccella frigid* ,*Ammonia beccarii*,and *Elphidium discoidal*. These species could be representing beach environment(Phleger,1960).This older foraminiferal assemblage is rather typical for the Holocene sediments environment (Bensonen,1997;EncarnaÇão,2006) especially the latter species was found in the Holocene sediments of southern Iraq(Al-Baidhany,1998).In relation to the ostracodal species that keep companied with the ancient species of foraminifera are mainly represented by *Cyprideis torosa* var.*torosa*. It is considered as known species of the Middle and Late Holocene sediments (Besonen, 1997; Culver *et al*., 2006). This species was found in the Holocene sediments of southern Iraq (Aqrawi, 1993; Al-Jumaily and Al-Shiekhly, 1999). On the basis of above foraminifera and ostracoda species, Holocene age assigned to studied sediments.

3- Lagoonal Biofacies (LB):

This biofacies found in; mud, clayey sand, and sandy mud sediments at depth ; (10-53 cm),(10-42 cm), and(0-13 cm) of cores; 5,6,and 7, respectively (Fig.2).

The dominant foraminiferal species are;*Dentostomina sp*., *Quinqueloculina seminula*, *Quinqueloculina seminulum*, *Ammonia beccarii*, *Elphidium advenum*, *E . discoidal*. And the lesser foraminifera species are; *Textularia conica*, *Spiroloculina communis*, *S. laevigata*, *Triloculina earlandi*, *Fissurina marginata*, *Bolivina nitida*,*B. striatula*, *Bulimina marginata*, *Buccella frigid*, *Rosalina globularis*, *Florilus asterizans*(the lesser presence).The dominant species reflect lagoonal environment(Phleger,1960;Javaux and Scott,2003). Generally all these species of dominant and lesser foraminifera are present in

the lagoon closest to the open marine water(Boltovskoy and Wright,1976).Other species of ostracoda also present such as; *Cyprideis torosa* var.*torosa*, *Hemicytheridea reticulate, Neomonoceretina delicata, Carinocythereis indica,*and *Alocopocythere reticulate*.

Observation in this facies is increase the species of foraminifera; *Bolivina striatula, Bulimina marginata, Buccella frigida,*and *Elphidium poeyanum* in addition to the rest species for muddy surface sediments which resembles that foraminiferal assemblages found in adjacent barrier islands or bars(Phleger,1960;Murray,1976)and this give idea about the growth and extension of the shoals. That means what happen in the shoals may be indicate subsidence in the region(Matthew,2006)specially the area a part of the Tigris-Euphrates Delta which is still actively subsiding (Kassler,1973).

Conclusions

Each of the different biofacies is defined by characteristic assemblages of the microfauna and in particular the foraminifera .The biofacies show relation between their environment and location.

The marine biofacies reflected nature of the Arabian Gulf water which entering Khor Al-Umaia at depth 20 meter or more. The biofacies of shoals was deltaic marine where ends the delta that affected by marine water. The solid part of shoals sediments support possibility their formation during the Holocene, which reveals a sea level recession. While review the surface sediments of shoals that near entrance of Khor Abdulla reveal continuance the deposition specially the recent of them where efficacy lagoonal environment.

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دراسة السحنات الحياتية لضحضاحات مختارة في شمال غرب الخليج العربي

بدر نعمة البدران و بشرى مجيد عيسى

قسم علم الأرض - كلية العلوم - جامعة البصرة

المستخلص

تناولت الدراسة الحالية الجزء الشمالي الغربي من الخليج العربي بالقرب من مدخل شط العرب والمدخل الجنوبي لخور عبد الله. استخدم جهاز جمع اللباب الجذبي ولعمق 60 سم من قاع الخليج. أجريت عملية النمذجة للفترة من 13 والى 15 أب 1995. أختير 19 نموذجا موزعا عموديا وافقيا لتغطية منطقة الدراسة. أجريت عملية التحليل الحجمي للرواسب وتم فصل المتحجرات من اجل تشخيصها. أظهرت النتائج أن الرواسب هي وحل رملي و رمل وحلي ووحل، كما بينت تجمعات المنخريات وصدفة القشريات ثلاث سحنات حياتية في المنطقة. عكست السحنات الحياتية؛ ظروف بيئة بحرية اعتيادية وبيئة بحرية دلتائية و بيئة لاغونية. أما بالنسبة الى الضحضاحات فقد اظهرت مستحاثاتها أختلاط أنواع حديثة مع اخرى قديمة للمنخريات وصدفة القشريات ، أما مستحاثات الاصداف القديمة والتي بدت وكأنها متحجرة ومتصلبة جدا مع وجودها في رواسب متماسكة والتي أظهرت تجمع حياتي للمنخربات ممثلا لبيئة ساحلية أشتهر في ترسبات الهولوسين. هذا الاستنتاج يعطي احتمال عائدية ترسبات هذه الضحضاحات الى فترة الهولوسين.

EXPLANATION OF PLATES

Plate (1)

1-*Textularia conica* (d'Orbigny),1839.

2-*Dentostomina sp*.

3-*Spiroloculina communis* (Cushman and Todd),1944.

4- *Spiroloculina laevigata* (Cushman and Todd),1944.

5-*Quinqueloculina laevigata* (d'Orbigny),1826.

6-*Quinqueloculina lamarckiana* (d'Orbigny),1839

7-*Quinqueloculina longirosta* (d'Orbigny),1826.

8- *Quinqueloculina seminula* (Linné),1758.

9- *Quinqueloculina seminulum* (Linné),1758.

10- *Triloculina earlandia* (Cushman,Todd and Post),1954.

11- *Triloculina planciana* (d'Orbigny),1839.

12- *Triloculina rotunda* (d'Orbigny),1826.

13-*Lagena laevis* (Montagu),1803.

14- *Lagena sulcuta* forma *interrupta* (Williamson),1848.

15- *Fissurina marginata* (Montagu),1803.

16- *Fissurina serrata* (Schlumberger),1894.

17- *Bolivina nitida* (Brady),1884.

18-*Bolivina striatula* (Cushman),1922.

Plate (2)

1- *Bulimina marginata* (d'Orbigny),1826.

2- *Buccella frigid* (Cushman),1922.

3- *Rosalina columbiensis* (Cushman),1925.

4-*Rosalin globularis* (d'Orbigny),1826.

5- *Ammonia beccarii* (Linné),1758.

6- *Asterorotalia dentata* (Parker and Jones)1865.

7- *Asterorotalia inflata* (Milliet)1904.

8- *Elphidium advenum* (Cushman),1922.

9- *Elphidium discoidal* (d'Orbigny),1839.

10- *Elphidium incertum* (Williamson),1858.

11-*Elphidium incertum clavatum* (Cushman),1930.

12-*Elphidium incertum mexicanum* (Kornfeld)1931.

13- *Elphidium poeyanum* (d'Orbigny),1839.

14-*Florilus asterizans* (Fichtel and Moll),1798.

Plate (3)

1- *Cytherelloidea sp*.

2- *Cyprideis toro*sa var. *torosa* (Jones),1850.

3- *Haplocytheridea subovata* (Ulrich and Basslev),1904.

4- *Haplocytheridea bradyi* (Stephenson),1938.

5- *Haplocytheridea keyseri* (jain),1978.

6-*Cushmanidea guhai* (jain),1978.

7-*Hemicytheridea reticulate* (Kingma),1948.

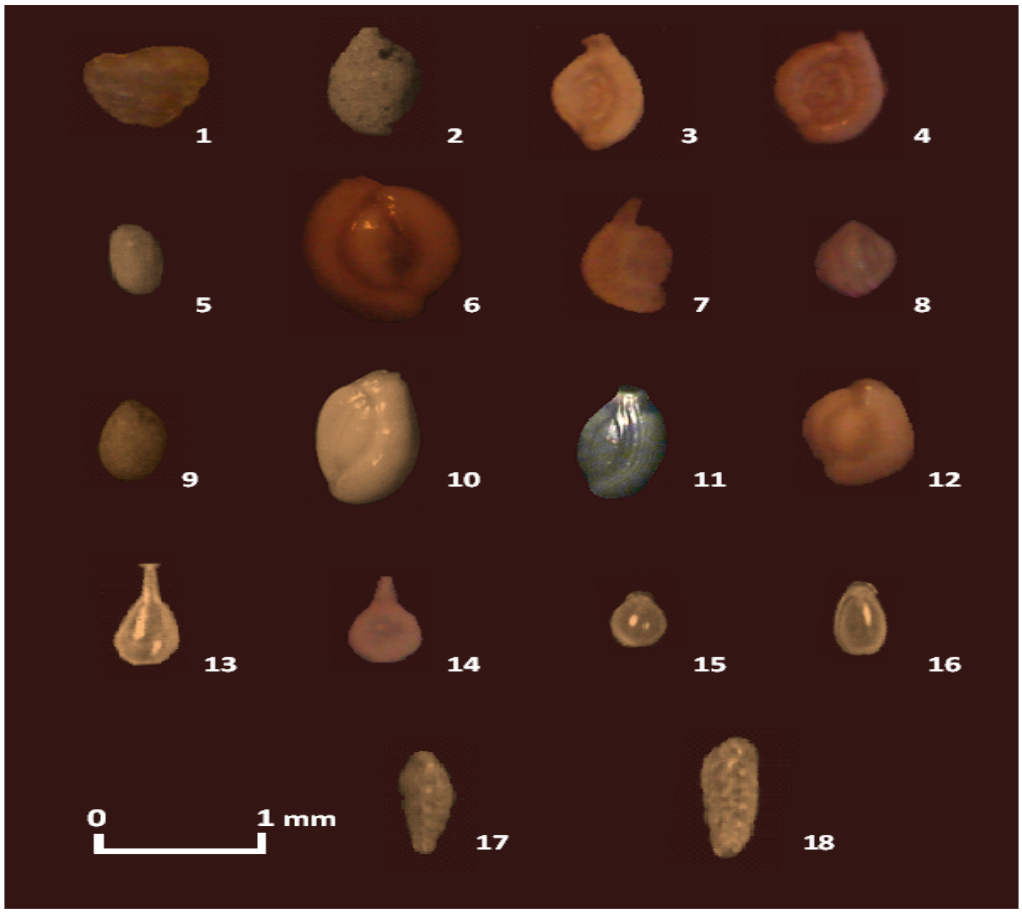
8-Neomenoceretina delicata (Ischizaki and Kato),1976 .

9-Paijenborchella(*Eupaijenborchella*) *sp*.

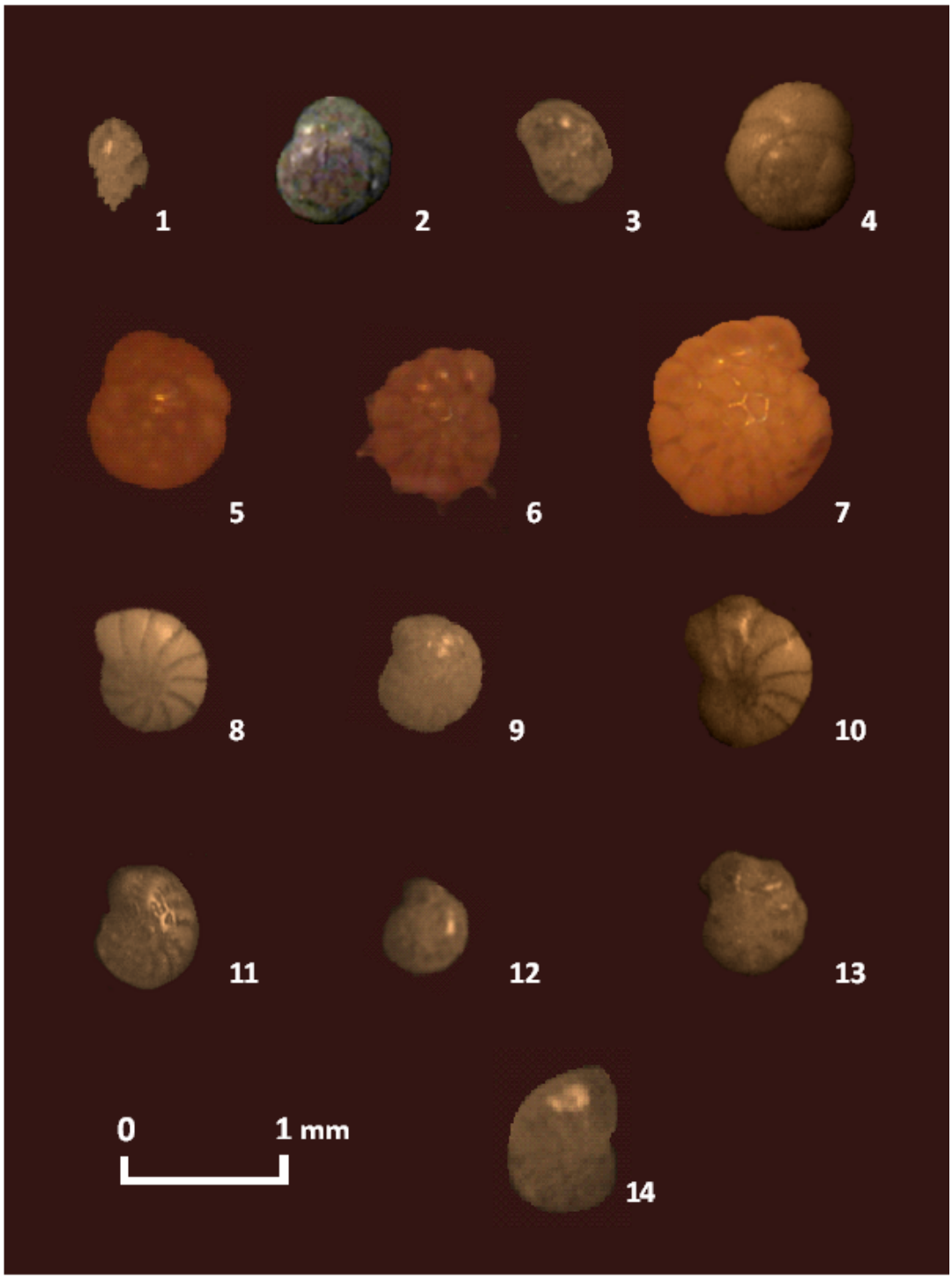
10- Carinocythereis indica (Jain),1978.

11-Alocopocythere reticulata Hartmann),1978.

Plate(1)



Plate(2)



Plate(3)